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COMPLETE SPECIFICATION

FOR A STANDARD PATENT

ORIGINAL

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Invention Title:	LONGITUDINAL RIP DETECTOR FOR RUBBER CONVEYOR BELTS.

Details of Associated Provisional Application No. PP5704 dated 7th September 1998

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

The invention relates to an electronic device which when embedded in a rubber conveyor belt, reinforced with longitudinal steel cord cables or laminations of fabric will detect an instrusion of a foreign body into the surface of the conveyor belt causing sufficient damage to the conveyor belt as to make it inoperable, however it will be appreciated that the invention is not limited to that field of use.

Reinforced rubber conveyor belts are used for many applications, though principally for conveying objects and/or material on mining sites, quarries, power stations etc., and are subject to damage from foreign bodies and objects larger than the equipment that the conveyor system is designed to carry.

This can cause belt breakages, severe tearing and cutting of the surface material as well as ripping along the longitudinal length of the belt. In some case a foreign object such as metal rods, tools and other objects accidentally included with the conveyed material, can penetrate the belt, particularly if the penetrating object is jammed in the loading shute or guide rollers or other structural parts of the conveyor system. This can cause the conveyor belt to be ripped longitudinally until the belt is stopped by the operator. Should this happen in the night time or in a remote area the belt can travel for a considerable distance before being detected and the subsequent damage to the belt is quite significant.

This type of damage is of a severe nature as the difficulty of repairing such a longitudinal rip is at a high cost and in extreme cases beyond repair and therefore the belt section has to be removed from the conveyor system and replaced with a new belt at considerable loss of production time as well as the cost of the belt and

installation costs. It is therefore an advantage to stop the belt from running the moment the belt has been penetrated by the foreign object.

The purpose therefore, of the invention is to stop the running of the belt as quickly as possible so as to minimise the damage to the belt, although the amount of damage incurred is subject to the frequency of the detectors incorporated in the belt.

Other types of detector systems rely on the embedding of induction coils or wire' Loops which have been inserted during the manufacturing process of the belt and therefore very difficult to install in an existing belt and uses an induction circuit to figure the stopping process of the conveyor belt.

Another method employed is the mounting of a simple cord mounted beneath the underside of the conveyor belt at a point most likely to be damaged and depends on the rip or tear in the conveyor belt being frayed enough on the underside to trip the cord and thus trigger the stopping device of the belt.

Other devices for detection depend on Ultrasonics to measure the disturbance in the ultrasonic sound waves projected onto the surface of the conveyor belt.

The invention referred to embodies a system where a flexible steel wire –10- of a small diameter (maximum 1mm) encased in a teflon tube is embedded into either the top –11- or the bottom cover material –12- of the conveyor belt, either during the manufacturing process or in-situ on a mining or conveyor system site to belts which have already been installed or have been in service for some period of time.

The steel wire –10- is coupled to a small electronic device –13- bypassing the steel wire through a hole –14- in the electronic circuit device which depresses a switching unit which maintains an open circuit status so that when the steel wire is removed, the electronic circuit is activated.

The electronic circuit is energised by a means of permanently connected lithium iron long life battery cell. The circuit remains passive and unenergised until the micro-switch incorporated in the electronic unit is closed, causing a current to flow to the electronic circuit which in turn transmits a radio frequency signal.

If a foreign body –17- penetrates the belt either fully or partially, then the foreign body should catch the embedded steel wire –10- and as the strength of the steel wire is sufficient to resist the breaking strength of the foreign body, the wire is pulled out of the electronic device –13- which causes the micro-switch contained therein –16- to close the circuit and activate the electronic circuit which then transmits the radio frequency signal –19-.

This signal is transmitted to a receiving station of a compatible frequency which activates an electrical relay –20- which is powered by a permanently connected 240 volt 50 cycle AC current, which in turn is connected to the shutdown circuit of the driving motors –21- which immediately stops the conveyor belt from running. In addition, it can be connected to an audible and/or visual alarm –22- which notifies the plant operator that the conveyor system has stopped. The speed of the stopping of the belt is dependent on the conveyor systems braking system. The number and frequency of the transmitters inserted into the conveyor belt

depends of the requirement of the user but the more frequent the detectors are installed then the less damage could occur to the conveyor belt as the distance travelled between detectors is reduced.

A number of receivers can also be mounted on the conveyor system and are recommended to be sited adjacent to the possible danger points where foreign bodies could pierce the conveyor belt.

The method of installing the trip wires and transmitters is explained in attachment 'A' and is generally carried out by trained belt splicing and repair operators. The installation is relatively simple and is commenced by cutting a groove either at 90° to the belt edge to a maximum of 45° to the belt edge at a depth of approximately 3mm either in the top cover or the bottom cover, however the preference is to be inserted in the bottom cover provided there is sufficient thickness of rubber covering that the groove would not interfere with the reinforcing members of the conveyor belt. Into this groove is laid the steel detector wire encapsulated in a teflon tube and the remaining part of the groove is covered with rubber repair material and inserted into a vulcanising press. At the same time a teflon mould is also inserted into the edge of the belt and on completion of vulcanisation, it is withdrawn leaving a cavity in the belt edge for the insertion of the transmitter unit and once the transmitter unit has been inserted in this cavity, can be fixed with a cold rubber moulding solution to prevent the unit from dislodging and the ingress of moisture.

It is expected that the life cycle of such a transmitting unit should be 10 years if it is not activated. Should a fault occur and penetration in the belt causes the alarm device to be tripped, it is discarded and replaced with a new unit. The illustration –12- depicts a steel cord reinforced belting, however the invention can also be applied to a conveyor belt of a fabric ply construction. Similarly the illustration also depicts the trip wire –10- to be inserted above the steel cables in what is referred to as the 'top cover' but can also be inserted in the bottom cover if sufficient depth of rubber is available without the risk of damaging the steel cord reinforcements.

ABSTRACT

The Longitudinal Rip Detector for conveyor belts is a device consisting of a steel trip wire encased in a teflon tube –10- attached to a radio frequency transmitting device –13- powered by a long life lithium iron battery –18-.

The steel wire encased in the teflon tube is embedded at frequent intervals across a rubber conveyor belt, either of steel cord construction or fabric cord construction, with the radio frequency transmitting device embedded in the edge of the conveyor belting –15-. If the belt is penetrated by a foreign object which would cause the belt to split or rip longitudinally, this foreign object catches the wire embedded in the conveyor belt causing it to activate a switch –16- which in turn energises a radio frequency circuit and transmits a coded signal which is received by a remotely mounted receiver –19- which activates a relay –20- which in turn interrupts the power to the drive motor –21- and stops the belt from running causing further damage to the conveyor belt.

The receiver is generally mounted in a location of most risk to belt penetration by foreign bodies, i.e. the loading shute, and is coupled to the emergency stopping circuits of the conveyor system which will cause the belt to stop running on penetration.

APPENDIX 'A'

RD4 RIP DETECTOR SYSTEM

INSTALLATION INSTRUCTIONS

1). Determine spacing of detectors along the belt length.

2). Cut a 6mm groove across the width of the belt using a grooving tool, preferably in the bottom cover to a sufficient depth to embed the detector wire sheathing and allow a covering of minimum 1mm filler rubber.

3). Cut away an area of 60mm long x 35mm wide x 10mm deep at the very edge of the belt to allow the teflon male mould to be inserted. The groove should be within 5mm of the end of the cutout (see Fig.1).

4). Cut a length of stainless steel wire from reel provided to approximately 25mm longer than the width of the belt.

5). Cut a length of teflon tube 40mm shorter than the width of the belt.

6). Bend a hook on the one end of the wire and thread through the teflon tube.

7). Insert wire and tube into the groove with the hook at the opposite edge of the belt from the cut out for the detector, the hook being approximately 20mm from the edge of the belt (see Fig.2).

8). Pass the straight end of the wire through the hole in the male mould (part no.1) and ensure the surface of the mould is below the belt surface by at least 1mm. (see Fig.3).

9). Cover the wire detector and mould with filler rubber after first preparing the groove with solution.

10). Cover area with teflon sheet and mount vulcanising press over area to be vulcanised.

11). Cure belt repair for time pressure and heat in accordance with the belt manufacturer's recommendations for belt thickness.

12). Remove vulcanising press and clean up repaired area.

13). Remove male mould from belt.

14). Remove 'safety pin' from the detector (part no.2) and check alarm signal with test box (part no.3). The alarm should give a buzzer noise if working correctly.

CAUTION!!

DO NOT INSTALL IF THIS TEST IS NOT SATISFACTORY.

15). Insert detector (part no. 2) making sure the wire is passed through the hole in the detector.(Fig 4)

THE ALARM SHOULD THEN CEASE

16). Push the detector into the space moulded into the belt edge, cut off protruding wire flush with detector, and seal with cold repair material.

17). Dress-up edges.

18). Proceed to next detector installation.

19). Mount receiver unit (part no.4) in a protected area as near to the loading point as possible.

20). Wiring should be carried out by a licenced electrician in accordance with current diagram.

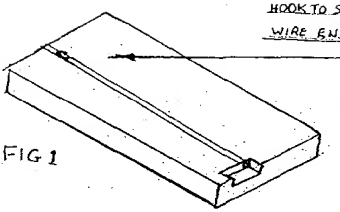


FIG 1

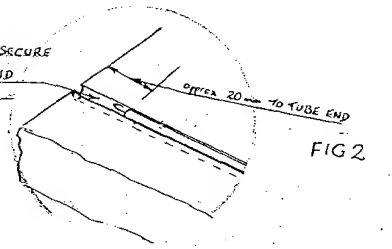


FIG 2

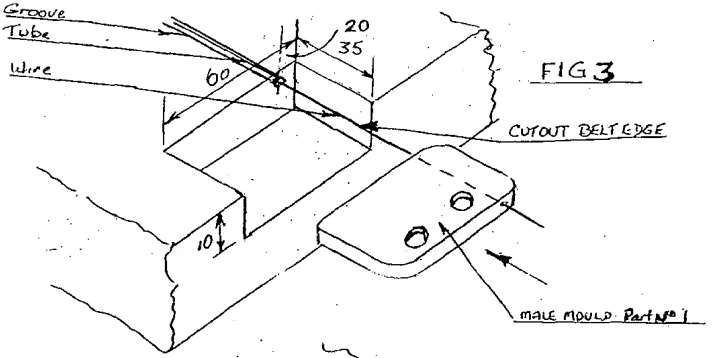


FIG 3

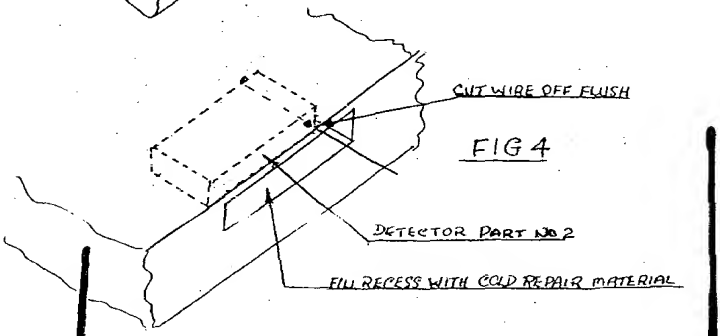
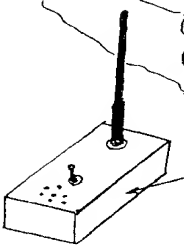
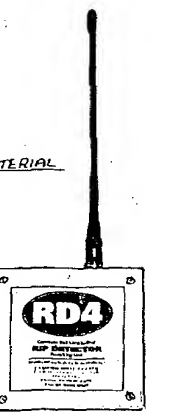


FIG 4

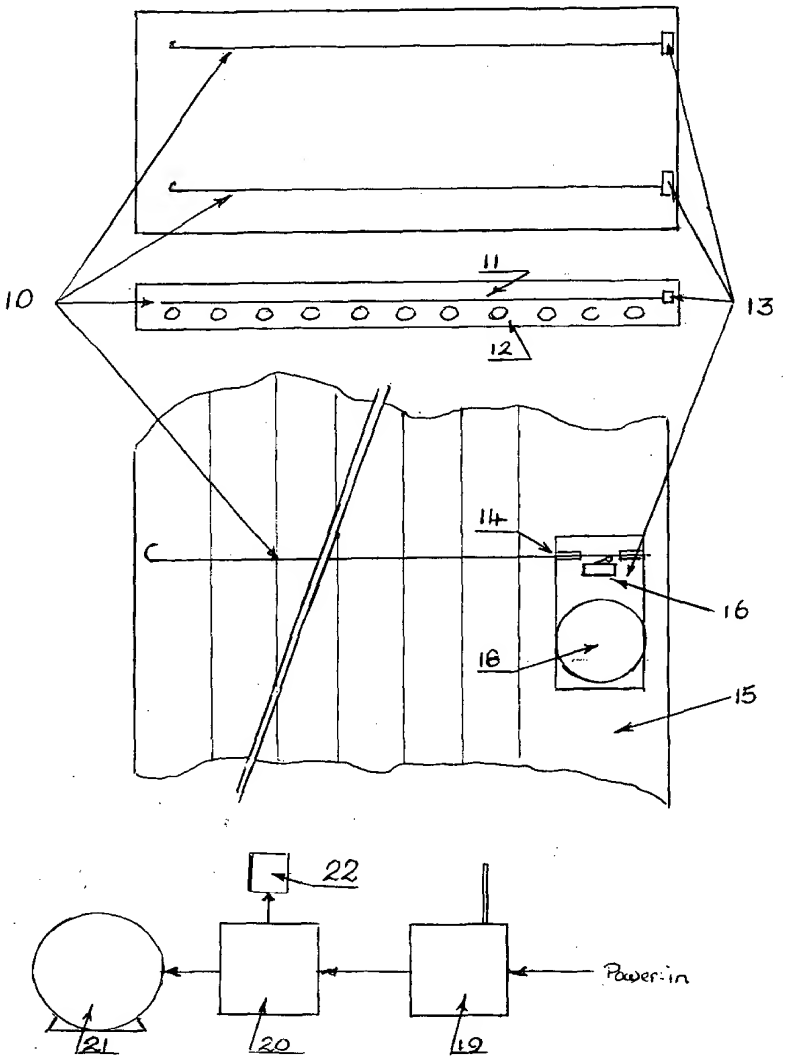




Reciever
Part No 4

No claims were lodged

with this application


10
11
12
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Power in
21
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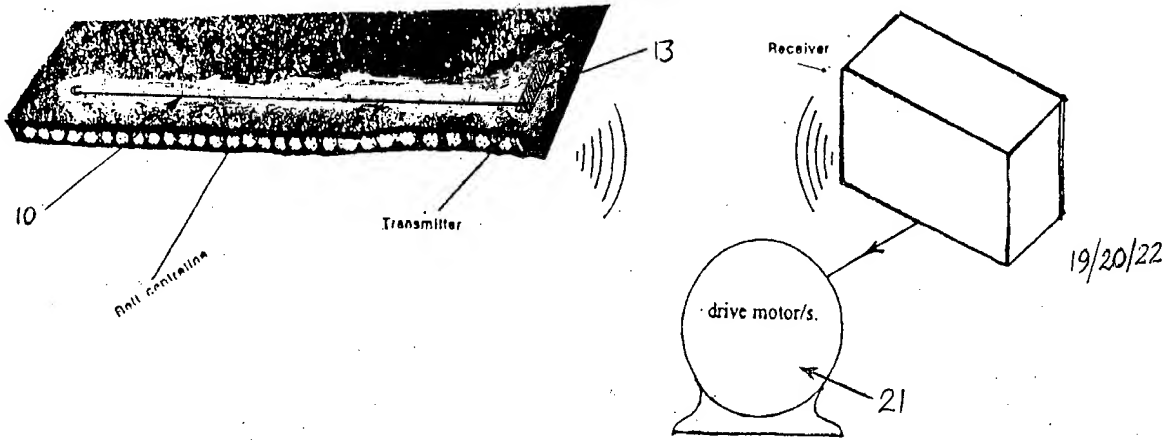
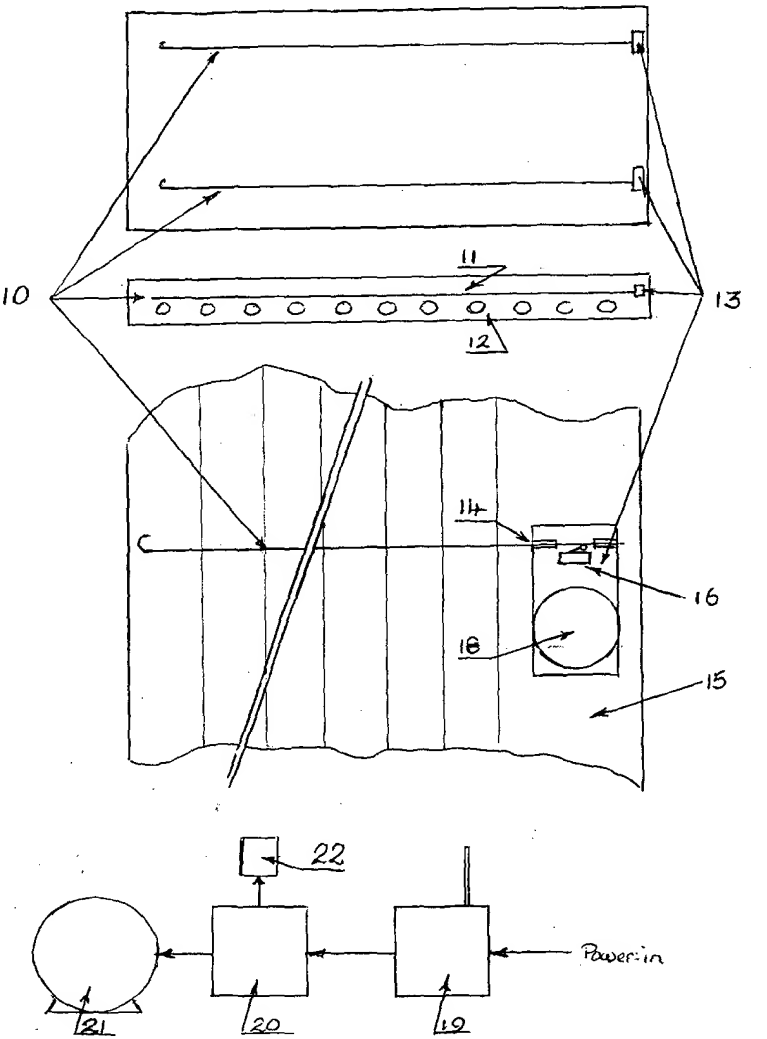
19


13
10
Transmitter
Receiver
drive motor/s.
21
19/20/22
Monitors 10
receiver 19
17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Power in
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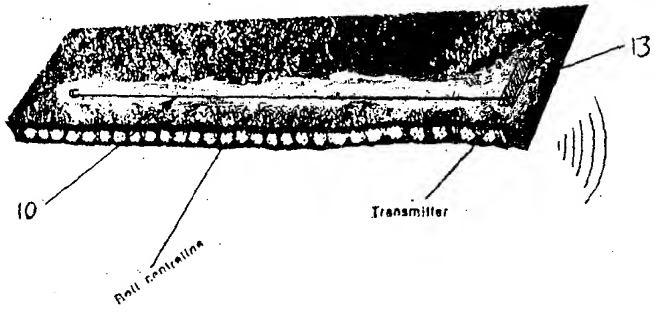
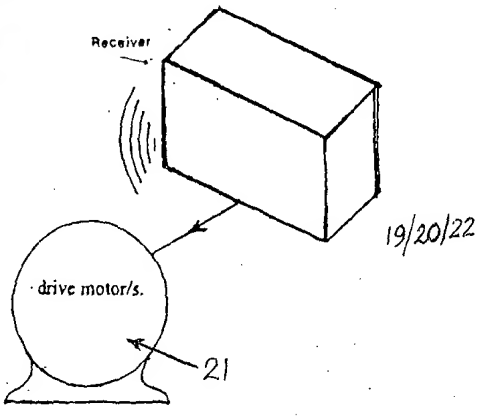
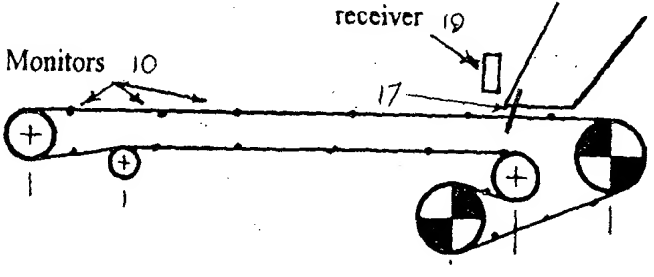

13
10
Transmitter


Receiver
drive motor/s.
21

19/20/22


receiver 19
Monitors 10
17